The Performance and Validation of GPM's Falling Snow Retrieval Algorithms

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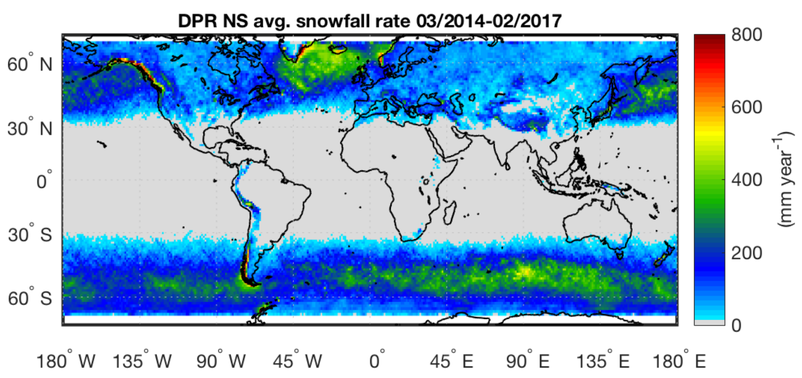
Introduction:

Precipitation falling in the form of snow is vitally important for society and the Earth's climate, geology, agriculture, and ecosystem. In some parts of the world, snow is the dominant precipitation type and relied upon year round for fresh water. The Global Precipitation Measurement (GPM) mission (launched 2014 in a partnership between NASA and JAXA) was specifically designed to remotely sense (estimate) both liquid rain and falling snow. This poster describes **preliminary results and performance evaluations of falling snow estimates** using the GPM Microwave Imager (GMI) and the Dual-frequency Precipitation Radar (DPR) on board GPM. All snow estimates are in liquid equivalent units.

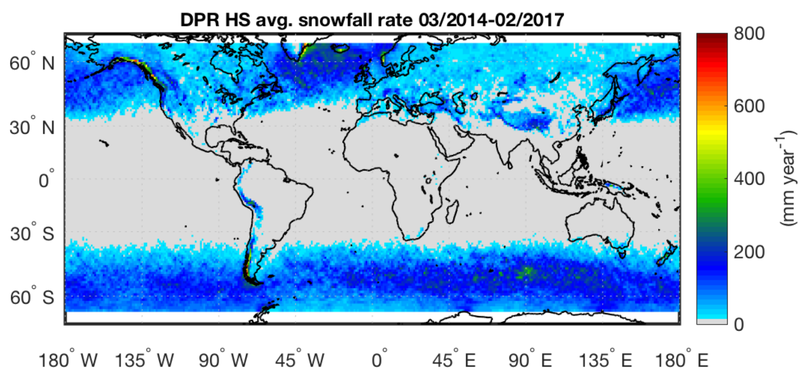
To compare GPM falling snow estimates with other sources of falling snow estimates, such as from CloudSat, we must ensure that the analysis is done properly as there are several factors that limit raw-product comparisons. These include those induced by: **phase classification, sampling, instrumentation (resolution/sensitivity), and algorithm differences**. Classification refers to the method used to assign rain or snow at the surface. Sampling due to differing swath widths and orbits causes additional disparities between the products. The instruments have different design features, most notably minimum detectable reflectivity and frequency sensitivities. Algorithm assumptions lead to dissimilarities that are more difficult to reconcile. A discussion of these four factors is also presented.

Global Falling Snow Estimates from GMI, DPR, and Combined (March 2014-February 2017)

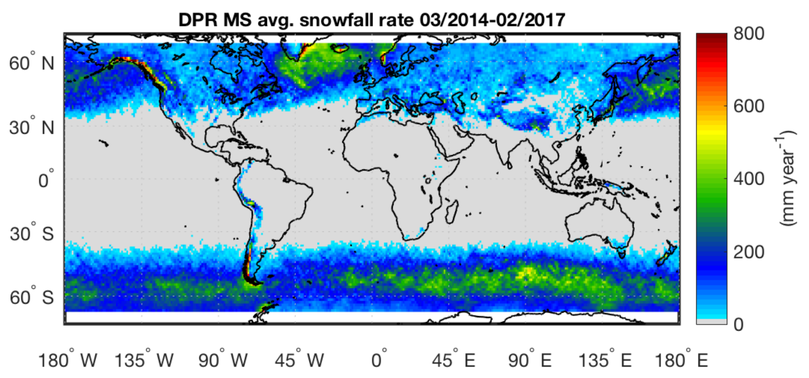
DPR NS (mm yr^{-1})



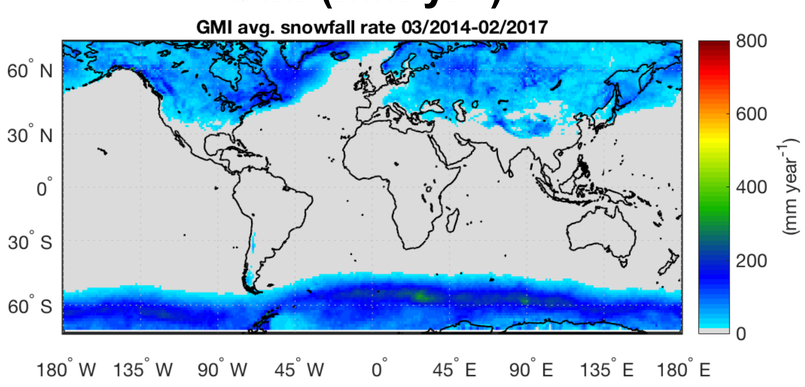
DPR HS (mm yr^{-1})



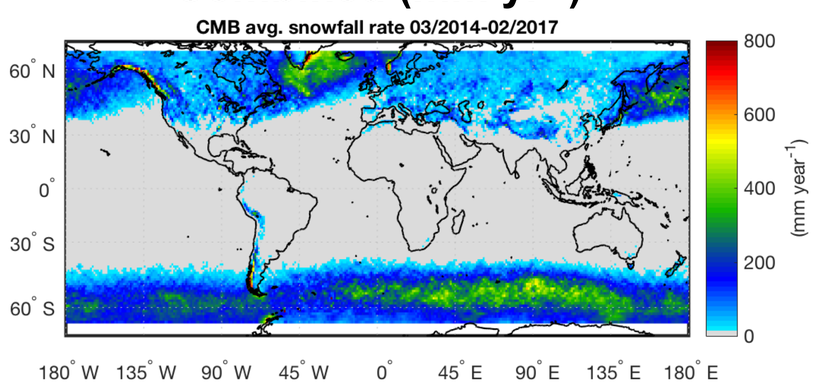
DPR MS (mm yr^{-1})



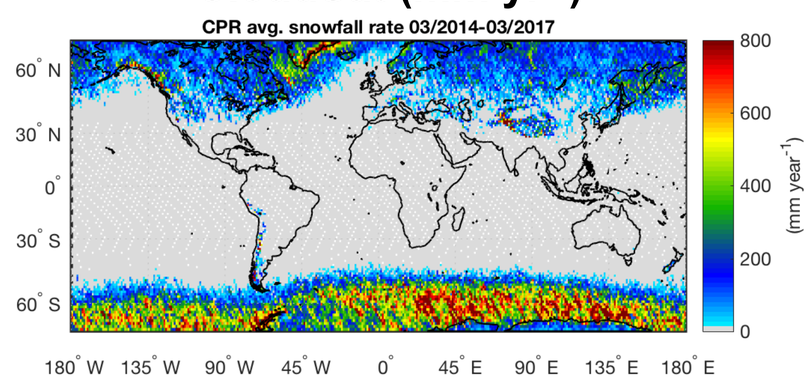
GMI (mm yr^{-1})



Combined (mm yr^{-1})



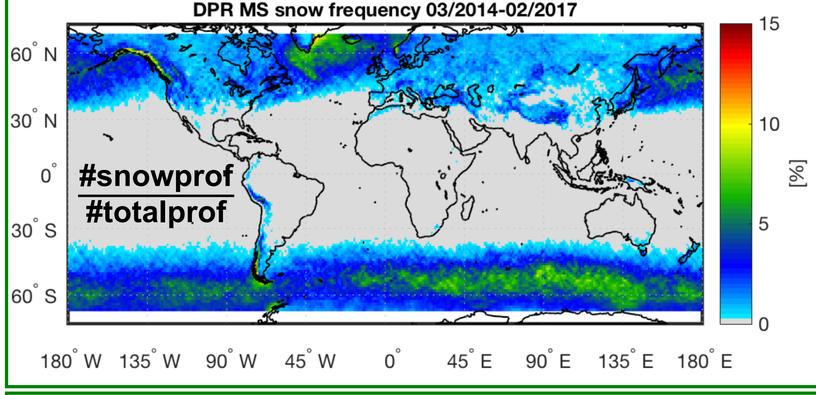
CloudSat (mm yr^{-1})



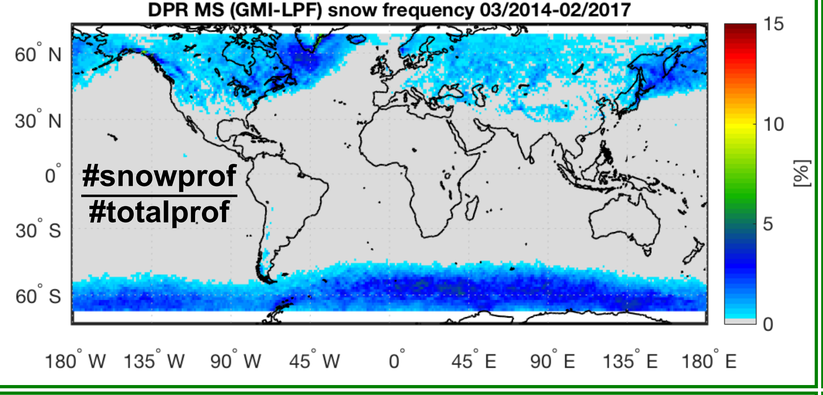
Challenges in Comparing GPM and CloudSat Falling Snow Estimates

Classification of phase at surface:

Using DPR T at lowest detected Z

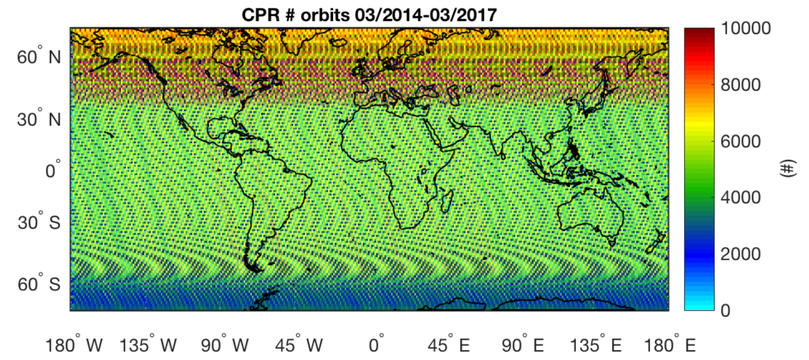


Using GMI (T2m) Sims & Liu (2015)



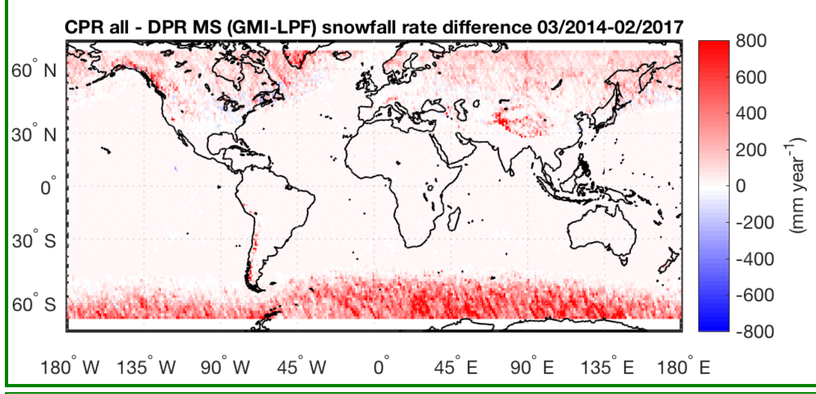
Sampling:

CloudSat NH bias due to daylight ops

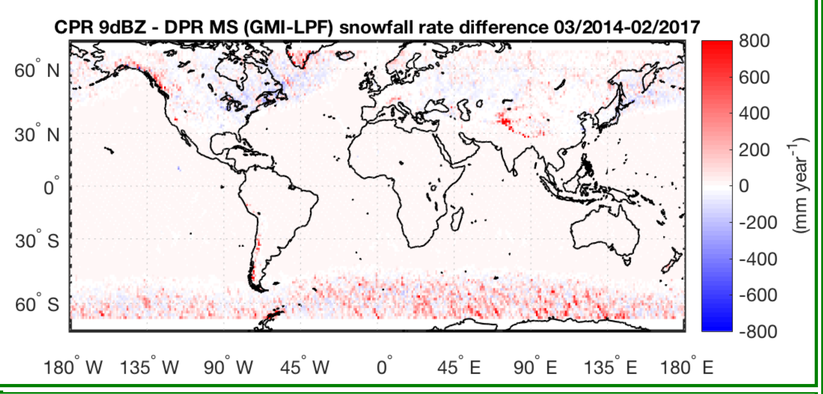


Instrument Induced:

CPR (all) – DPR MS (T2m)



CPR (>9 dBZ) – DPR MS (T2m)



Algorithm Induced:

Instrument	Snow Occurrence (%)	Mean Snow Rate (mm/day)
CloudSat (native res)	2.422	0.1229
DPR-NS	0.262	0.0401
DPR-MS	0.262	0.0402
DPR-HS	0.199	0.0208
CloudSat (5-pixel)	2.879	0.1212
CloudSat (15-pixel)	3.516	0.1208
CloudSat (15-pixel, 8 dBZ cutoff)	0.276	0.0556

Table data uses DPR T2m

Despite yielding a similar occurrence, a cutoff of 8-9 dBZ for CPR yields a mean snowfall rate 30-40% higher than DPR-MS. The algorithm differences lead to higher snowfall rates from CPR than DPR, even when the same events are being observed.

Acknowledgments

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